Undergraduate Research

Austin Urban, Ethan Gabrielle, RJ Morley, Alex Ray

Purpose

Attempt to characterize and describe successful forms and mechanisms of undergraduate research (UGR) in order to provide context for a future expansion of research opportunities at CU Boulder, particularly in non-STEM areas and interdisciplinary fields.

Overview

- Background
- Principles and best practices
- Existing programs at CU
- CU tracking with best practices
- Recap

Scope and Opportunity

- “Rethinking the university--the futures of learning and discovery”
  - Not concerned with time, space, money
- Survey wide array of programs
  - STEM, SS, AHUM
- Broad investigation
  - Focus on “what”, “why”

Why Undergraduate Research?

- Improvements in "soft skills" (Lopatto 2007)
  - Autonomy, critical thinking
- Measurable educational benefits (Boylan 2006)
  - UGR is a "high-impact practice" (Lopatto 2010)
- Mentor relationships mutually beneficial (Petrella et al. 2008)
- Expands perceived career options (Zydney et al. 2002)

Discoverability

- Centralized online interface
  - One roof, all disciplines
  - Affords interdisciplinary outreach
- In-person office
  - Information on opportunities, funding
- Accessibility
  - More equity in opportunities

UCLA

- Arts and Humanities *Undergrad Research Center*
  - Online and physical presence
- Undergrad research portal
  - Student “research profiles”, searching mechanisms

Berkeley
UNIVERSITY OF CALIFORNIA

- Well organized, centralized website
  - Easy to find and review desired projects
- Simple, straightforward application process

Principles and Practices

Berkeley
UNIVERSITY OF CALIFORNIA

urap berkeley undergraduate research apprentice program

Project Descriptions Spring 2018

- Arts and Humanities
- Biological and Health Sciences
- Digital Humanities and Data Science
- Education, Cognition and Psychology
- Engineering, Design and Technologies
- Environmental Issues
- Physical Sciences
- Social Sciences
- Open Projects

All current projects: 368 Faculty/Mentors

Agricultural and Resource Economics

Aprajit Mahajan, Professor Agricultural and Resource Economics

(1) Indian Judicial Data Project (Current Term Now Closed)

Sofia Villas-Boas, Professor Agricultural and Resource Economics

(1) Machine learning on satellite data (Current Term Now Closed)

David Zilberman, Professor Agricultural and Resource Economics

(1) What is the effect of "resting" NBA players on ticket prices? A case study of entertainment value in response to risk. (Full- no new appr needed)

Anthropology

Sabrina Agarwal, Professor Anthropology

(1) Microscopic examination of dental enamel defects: a bioarchaeological investigation of childhood stress and mortality in medieval Italy (Full- no new appr needed)
(2) Everyday life at Rural Medieval Villamagna (Current Term Now Closed)
(3) Comparing cortical bone quantity in ribs and metacarpals: A bioarchaeological case study of bone development, maintenance and loss from the Colombian Muisca (Full- no new appr needed)
(4) American Eugenics Collection Practices and History (Current Term Now Closed)

urap berkeley undergraduate research apprentice program

Project Descriptions Spring 2018

Arts and Humanities
Biological and Health Sciences
Digital Humanities and Data Science
Education, Cognition and Psychology
Engineering, Design and Technologies
Environmental Issues
Physical Sciences
Social Sciences
Open Projects
All Projects

Aprajit Mahajan, Professor

(1) Indian Judicial Data Project

Applications for Spring 2018 are now closed for this project.

The questions examining the relationship between a country's legal environment and its economic outcomes are important. These are motivated by theories linking judicial efficiency and economic outcomes as developed under the new institutional economics (North, 1990 and Williamson, 1995). First, as a regulator, the judiciary is responsible for enforcing the rules of law. Inefficiency in enforcement makes the rule of law weaker and may hurt economic activity. Second, as an enforcer of contracts, judicial efficiency is likely to be important for firm outcomes where delays in contract enforcement lead to opportunistic behavior, lowering productive efficiency. We will be studying this within the context of India.

We are looking for motivated research assistants who can help us build, clean and analyze large datasets of judicial information from India through National Judicial Data Grid web portal. This dataset will be used towards addressing the causal relationship between the judiciary and economic activities. We are looking for candidates with substantial knowledge of programming languages/scripts and some experience with web data extraction.

Day-to-day supervisor for this project: Manaswini Rao, Ph.D. candidate

Qualifications: 1) Programming, preferably in python (required). 2) Knowledge of specific libraries and tools for web data extraction (required). 3) Interest or familiarity with any GIS tools (preferred).

Weekly Hours: 9-12 hrs

Incentivizing Relationships

- Alleviate UGR negatives for faculty (Petrella et al. 2008, Berri et al. 2012, Ülkü et al. 2017)
  - Favorable review interface
  - Improve faculty reward structure
  - Potential course relief
- Widespread peer mentor program
  - Benefits both mentor and mentee (Lopatto 2010)
- Utilize discoverability to make connections

Principles and Practices

- Collaborative peer & faculty mentorship program
  - Campus-wide
- Incentives for mentors
  - Prizes, awards
  - Professional development workshops

UNIVERSITY of WASHINGTON

- Formal *Research Centers and Institutes* program
  - Campus-wide
  - Affords more natural professional connections
  - ~300 interdisciplinary centers and institutes

Support for Faculty

- Faculty workshops
- Elicit inter-department collaboration
  - Research discovery interface catering to faculty
  - “Community of practice”
- Scalable research framework
  - “Research collaboratives” in AHUM, SS
  - Expand undergrad role in CHA, CARTTS

Stanford University

University of Pittsburgh

- Significant investment in faculty collaboration
  - *James H. Clark Center*
- Office of the *Vice Provost for Teaching and Learning*
  - Resources for faculty, workshops
- Fleshed-out *Center for Teaching and Learning*
  - Includes Center for Mentoring
  - Formal faculty credentialing and workshopping
  - *Teaching and Learning Exchange*

Example Programs at CU

- Undergraduate Research Opportunities
- Discovery Learning Apprenticeship
- BSI Scholars
- Informal
  - Traditional lab opportunities
  - Capstone, project courses
  - Honors, senior theses

CU Tracking With Best Practices

- No campus-wide interface for research
  - Entrenches STEM focus
- Traditional faculty review structure
  - Discourages time investment in UGR
    (Malachowski 2017)
- Lacks significant faculty support
  - No framework for ongoing pedagogical education

Recap

Benefits for Students and CU

- Development of valuable skills
  - Soft skills including critical thinking, problem solving, communication
  - Career-applicable experience
- Supports underrepresented students (Osborn et al. 2009, Gregerman)
  - Retention, persistence, engagement
- Funding, overall academic output benefits (Petrella et al. 2008)

Notes

PDFs of relevant literature available on shared Drive

Additional resources to be added, along with final consulting report

References

1. Lopatto, D. (2007). Undergraduate Research Experiences Support Science Career Decisions and Active Learning. *CBE Life Sciences Education*, *6*(4), 297–306. http://doi.org/10.1187/cbe.07-06-0039
2. Boylan, M., “The Impact of Undergraduate Research Experiences on Student Intellectual Growth, Affective. Development, and Interest in Doing Graduate Work in STEM: A review of the empirical literature,” Doctoral. Education and the Faculty of the Future, Cornell University, Ithaca, NY, Oct. 2006, Last accessed: Apr. 2018
3. Lopatto, D. (2010, Spring). Undergraduate Research as a High-Impact Student Experience. *Peer Review*, *12*(2).
4. PETRELLA, J. K., & JUNG, A. P. (2008). Undergraduate Research: Importance, Benefits, and Challenges. *International Journal of Exercise Science*, *1*(3), 91–95.
5. ZYDNEY, A. L., BENNETT, J. S., SHAHID, A. and BAUER, K. W. (2002), Impact of Undergraduate Research Experience in Engineering. Journal of Engineering Education, 91: 151-157. doi:10.1002/j.2168-9830.2002.tb00687.x
6. Berri, S., Zhang, A., & Gailani, G. (2012). *American Society for Engineering Education*, 25. Retrieved April 23, 2018.
7. M. Ali Ülkü, Andrea M. Karkowski & Terry D. Lahm (2017) Perspectives on interdisciplinary undergraduate research, Educational Studies, DOI: 10.1080/03055698.2017.1347497
8. Malachowski, M. (2017, October 08). Saying Yes to Undergraduate Research. *Chronicle of Higher Education*. Retrieved April 23, 2018, from https://www.chronicle.com/article/Saying-Yes-to-Undergraduate/241396
9. Osborn, J. M. and K. K. Karukstis. 2009. The benefits of undergraduate research, scholarship, and creative activity. In: M. Boyd and J. Wesemann (Eds.), Pages 41-53, Broadening Participation in Undergraduate Research: Fostering Excellence and Enhancing the Impact. Council on Undergraduate Research, Washington, DC.
10. Gregerman, S. R. Promising Practices in STEM Education National Academy of Science The Role of Undergraduate Research in Student Retention, Academic Engagement, and the Pursuit of Graduate Education.